

PART NUMBER: VQB75W

DESCRIPTION: dc-dc converter

features

- 75W isolated output
- Efficiency to 87%
- 300 kHz switching frequency
- input under-voltage protection
- over-temperature protection
- over-current protection
- remote on/off
- industry standard quarter-brick package


-MODEL

	input voltage		output voltage (V dc)	output current ¹ (A)	input current		efficiency typ. ³ (%)
	nominal (V dc)	range (V dc)			no load ² (mA)	full load ² (mA)	
VQB75W-Q24-S3R3	24	9.0~36.0	3.3	12	50	2037	81
VQB75W-Q24-S5	24	9.0~36.0	5	12	50	2976	84
VQB75W-Q24-S12	24	9.0~36.0	12	6.25	50	3634	86
VQB75W-Q24-S15	24	9.0~36.0	15	5	50	3634	86
VQB75W-Q24-S24	24	9.0~36.0	24	3.12	50	3628	86
VQB75W-Q48-S3R3	48	18.0~75.0	3.3	12	30	1006	82
VQB75W-Q48-S5	48	18.0~75.0	5	12	30	1471	85
VQB75W-Q48-S12	48	18.0~75.0	12	6.25	30	1817	86
VQB75W-Q48-S15	48	18.0~75.0	15	5	30	1796	87
VQB75W-Q48-S24	48	18.0~75.0	24	3.12	30	1796	87

notes:

1. see output derating (page 3)
2. input currents are measured at nominal input voltage
3. efficiency is measured at nominal line, full load

INPUT

parameter	conditions/description	min	nom	max	units
input voltage range		9	24	36	V dc
		18	48	75	V dc
under voltage lockout	24 Vin power up		8.8		V dc
	24 Vin power down		8		V dc
	48 Vin power up		17		V dc
	48 Vin power down		16		V dc
remote on/off control ⁴	section 3 in the application notes				
input filter	PI type				

notes:

4. add suffix "N" to the model number for negative logic on/off control

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OUTPUT

parameter	conditions/description	min	nom	max	units
voltage accuracy				±1.5	%
transient response	75 ~ 100% step load change				
	recovery time			500	μ sec
	error band		±5		%Vout
external trim adj. range				±10	%
ripple & noise (20MHz BW) ⁵	3.3V, 5V			40	mV RMS
				100	mV pk-pk
	12V& 15V			60	mV RMS
				150	mV pk-pk
	24V			100	mV RMS
				240	mV pk-pk
temperature coefficient			±0.03		%/°C
short circuit protection	continuous				
line regulation ⁶				±0.2	%
load regulation ⁷				±0.2	%
over voltage protection trip range, % Vo nom.		115		140	%
over current protection	% nominal output current	110		140	%

GENERAL SPECIFICATIONS

parameter	conditions/description	min	nom	max	units
switching frequency			300		KHz
operating ambient temp. ⁸		-40		100	°C
storage temperature		-55		105	°C
thermal shutdown case temp.			105		°C
case material	aluminum base-plate, plastic case				

ISOLATION SPECIFICATIONS

parameter	conditions/description	min	nom	max	units
isolation voltage	input/output	1500			V dc
	input/case	1500			V dc
	output/case	1500			V dc
isolation resistance	tested at 500 V dc	100			MΩ

notes:

5. measured w/10 μF and 1 μF ceramic capacitors across output
6. measured from high line to low line at full load
7. measured from full load to zero load at nominal input
8. see output derating curve (page 3)

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APPLICATION NOTES

1. OUTPUT DE-RATING

The operating case temperature range for VQB75W is -40 ~ +100°C. When operating the VQB75W series, proper derating or cooling is needed. The maximum case temperature under any operating condition should not exceed 100°C.

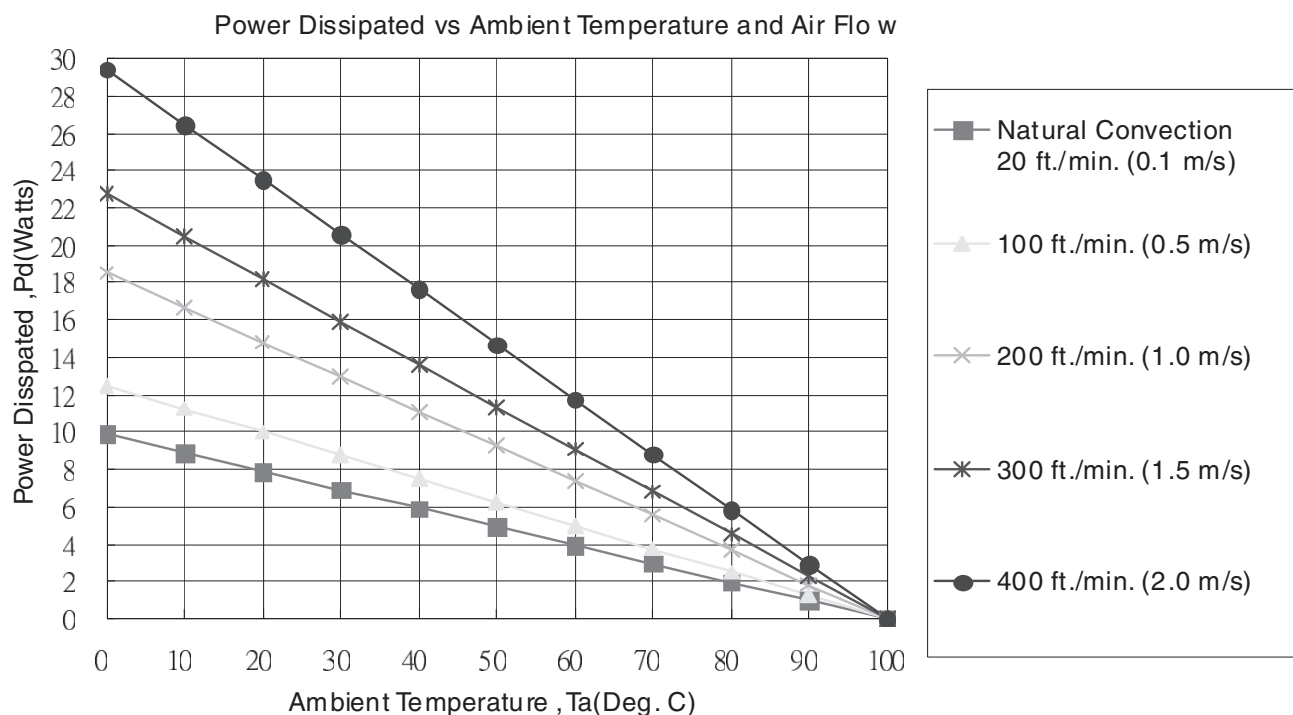


FIGURE 1. OUTPUT DERATING (FORCED CONVECTION WITH NO HEAT SINK)

Example:

What is the minimum airflow necessary for a VQB75W-Q48-S5 operating at nominal line, an output current of 20 A, and a maximum ambient temperature of 40°C?

Solution:

Given: $V_{in}=48$ V dc, $V_o=5$ V dc, $I_o=12$ A

Determine Power dissipation (Pd):

$$P_d = P_i - P_o = P_o(1 - \eta) / \eta$$

$$P_d = 5 \times 12 \times (1 - 0.85) / 0.85 = 10.59 \text{ W}$$

Determine airflow:

Given: $P_d=10.59$ W and $T_a=40^\circ\text{C}$

Check above Power de-rating curve:

minimum airflow= 200 ft./min.

Verifying:

The maximum temp. rise $\Delta T = P_d \times R_{ca} = 10.59 \times 5.4 = 57.19^\circ\text{C}$. The maximum case temperature $T_c = T_a + \Delta T = 97.19^\circ\text{C} < 100^\circ\text{C}$

Where:

The R_{ca} is thermal resistance from case to ambience. The T_a is ambient temperature and the T_c is case temperature.

AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	10.1 °C/W
100 ft./min. (0.5m/s)	8.0 °C/W
200 ft./min. (1.0m/s)	5.4 °C/W
300 ft./min. (1.5m/s)	4.4 °C/W
400 ft./min. (2.0m/s)	3.4 °C/W

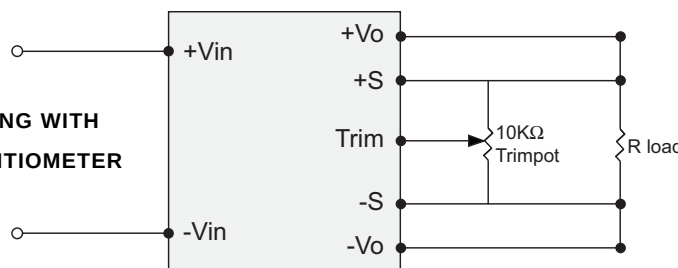
Chart of Thermal Resistance vs Air Flow

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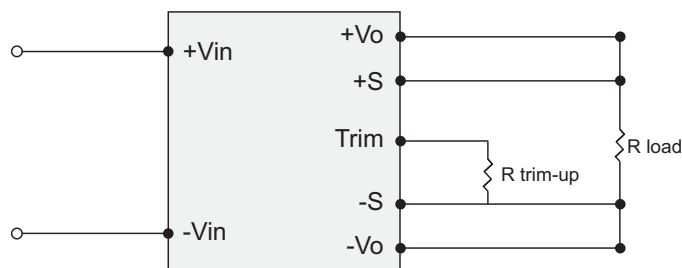
2. OUTPUT TRIMMING (OPTIONAL)

The output voltages are preset to nominal values as indicated by the models table at the factory. If desired, the output voltage may optionally be trimmed to a different value (+/- 10%) with external resistors and/or potentiometer as shown below.

FIGURE 2. TRIMMING WITH EXTERNAL POTENTIOMETER


To trim the output voltage with fixed resistors, the output voltage can be calculated as follows.

Trim-Up


FIGURE 3: TRIM-UP VOLTAGE SETUP

The value of $R_{trim-up}$ is defined as:

$$R_{trim-up} = \left(\frac{R_1(V_r - V_f) \left(\frac{R_2}{R_2 + R_3} \right)}{V_o - V_{o,nom}} \right) - \frac{R_2 R_3}{R_2 + R_3} \text{ (K}\Omega\text{)}$$

Where: $R_{trim-up}$ is the external resistor in KΩ. $V_{o,nom}$ is the nominal output voltage. V_o is the desired output voltage.

R_1 , R_2 , R_3 , V_f and V_r are internal to the unit and are defined in Table 1.

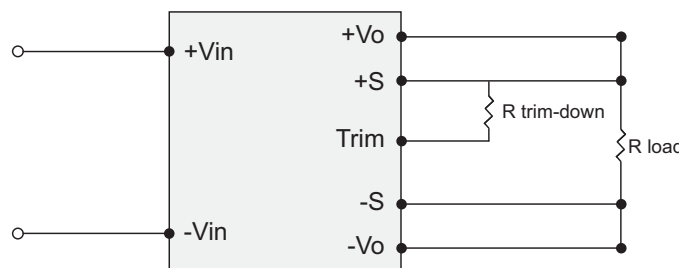
For example, to trim-up the output voltage of 12.0 V module (VHB50W-Q48-S12) by 5% to 12.6 V, $R_{trim-up}$ is calculated as follows:

$$V_o - V_{o,nom} = 12.6 - 12 = 0.6 \text{ V}$$

$$R_1 = 9.1 \text{ K}\Omega, R_2 = 51 \text{ K}\Omega, R_3 = 5.1 \text{ K}\Omega, V_r = 2.5 \text{ V}, V_f = 0.46 \text{ V}$$

$$R_{trim-up} = \frac{18.944}{0.6} - 4.636 = 26.94 \text{ (K}\Omega\text{)}$$

Trim-Down


FIGURE 4: TRIM-DOWN VOLTAGE SETUP

The value of $R_{trim-down}$ is defined as:

$$R_{trim-down} = \frac{R_1 \times (V_o - V_r)}{V_{o,nom} - V_o} - R_2 \text{ (K}\Omega\text{)}$$

Where: $R_{trim-down}$ is the external resistor in KΩ. $V_{o,nom}$ is the nominal output voltage. V_o is the desired output voltage.

R_1 , R_2 , R_3 , V_f and V_r are internal to the unit and are defined in Table 1.

For example, to trim-down the output voltage of 12.0 V module (VHB50W-Q48-S12) by 5% to 11.4 V, $R_{trim-down}$ is calculated as follows:

$$V_{o,nom} - V_o = 12 - 11.4 = 0.6 \text{ V}$$

$$R_1 = 9.1 \text{ K}\Omega, R_2 = 51 \text{ K}\Omega, V_r = 2.5 \text{ V}$$

$$R_{trim-down} = \frac{9.1 \times (11.4 - 2.5)}{0.6} - 51 = 83.98 \text{ (K}\Omega\text{)}$$

Table 1

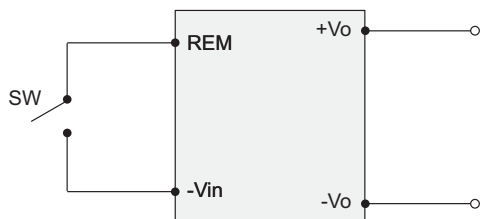
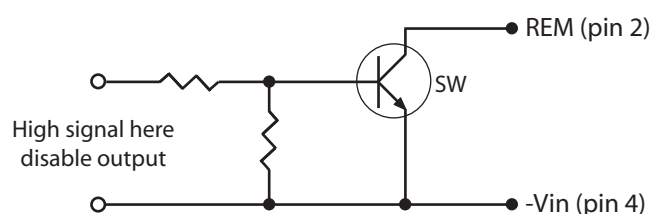
Output Voltage (V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vr (V)	Vf (V)
3.3 V	3.0	12	4.3	1.24	0.46
5 V	2.32	3.3	0	2.5	0
12 V	9.1	51	5.1	2.5	0.46
15 V	12	56	8.25	2.5	0.46
24 V	20	100	7.5	2.5	0.46

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3. REMOTE OUTPUT ON/OFF CONTROL

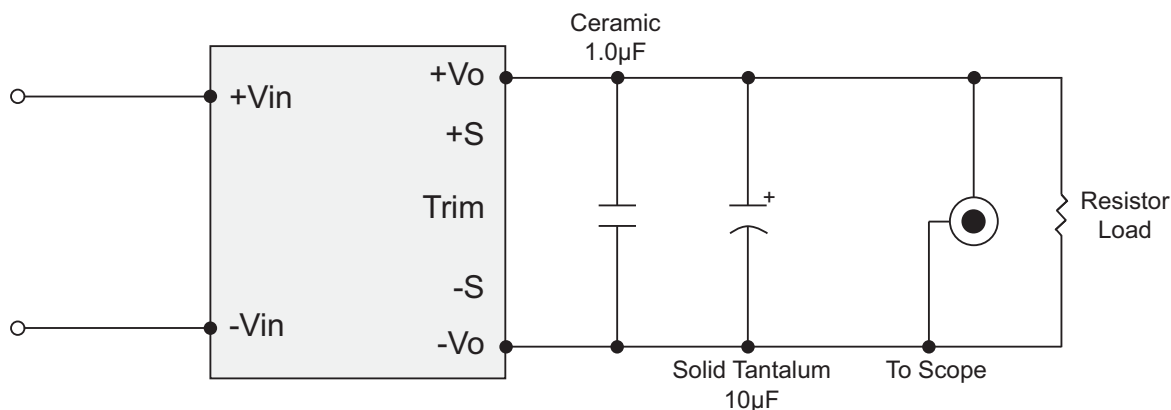
The converter output can be enabled or disabled through the On/Off pin. The control logic is shown in this table. A common control circuit is shown below.


FIGURE 5. REMOTE ON/OFF CONTROL

**FIGURE 6. REMOTE ON/OFF CONTROL
WITH TRANSISTOR SWITCH**

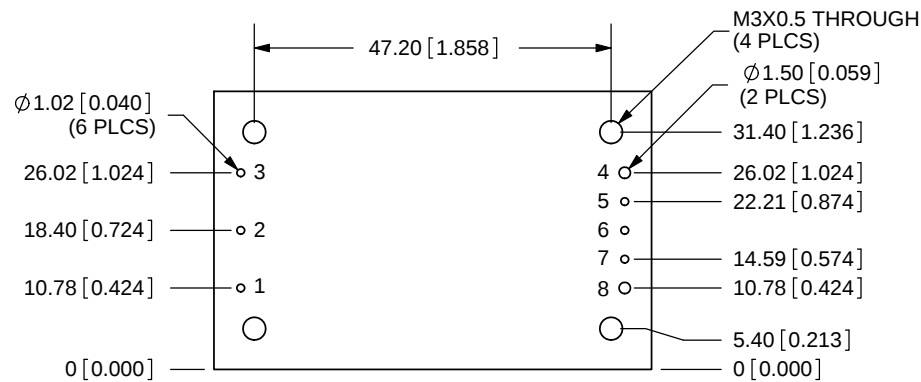
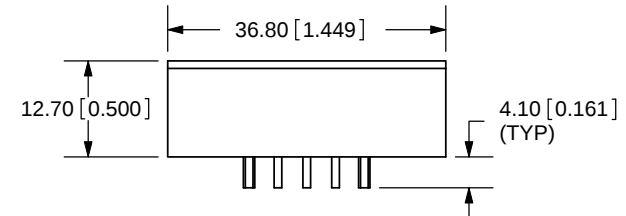
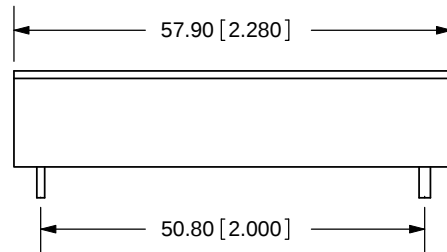
Logic Table	Negative logic	Positive logic
SW Closed ($V_{REM} < 1.8 \text{ V}$)	Output on	Output off
SW Open ($V_{REM} > 3.5 \sim 75 \text{ V dc}$)	Output off	Output on

4. OUTPUT NOISE MEASUREMENT SCHEMATIC

For proper output ripple and noise measurement, connect a $10\mu\text{F}$ tantalum and a $1\mu\text{F}$ ceramic capacitor across the output. Set the scope bandwidth to 20MHz. Probe directly off of one of the capacitors, using a small ground clip to minimize measurement error.


FIGURE 7. OUTPUT NOISE MEASUREMENT CIRCUIT

REV.	DESCRIPTION	DATE
A	NEW DRAWING	12/30/2008



TOLERANCE:
X.X $\pm 0.5\text{mm}$
X.XX $\pm 0.25\text{mm}$



PIN CONNECTION	
Pin	Function
1	+Vin
2	ON/OFF
3	-Vin
4	-Vout
5	-Sense
6	Trim
7	+Sense
8	+Vout



CUI INC

20050 SW 112th Ave.
Tualatin, OR 97062
Phone: 503-612-2300
800-275-4899
Fax: 503-612-2383
Website: www.cui.com

TITLE: DC-DC CONVERTER		REV: A
PART NO. VQB75W		UNITS: MM [INCHES]
DRAWN BY: JMS	APPROVED BY:	SCALE: 1:1

PC FILE NAME:
VQB75W

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